

VF: WATER-- FLUORIDATION

Fluorides

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FLUORIDATION OF WATER SUPPLIES
AND THE
CONTROL OF DENTAL CARIES



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PART 1

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An examination of claims made in opposition to Fluoridation of Public Water Supplies.

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Adapted from a compilation made by the American Dental Association.

PART 11

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Council on Dental Therapeutics,
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From "The Journal of the American Dental
Association," September, 1952.

REPORT OF THE AD HOC COMMITTEE ON FLUORIDATION
OF WATER SUPPLIES, SUMMARY AND CONCLUSIONS

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Division of Medical Sciences,
National Research Council,
Washington, D. C., November 29, 1951.

PART I

AN EXAMINATION OF CLAIMS MADE IN OPPOSITION
TO FLUORIDATION OF PUBLIC WATER SUPPLIES1. FLUORIDES IN THE PUBLIC WATER SUPPLY MAY HAVE A HARMFUL
EFFECT ON HUMAN BEINGS.

For generations over 4,000,000 people in the United States have been living all their lives in areas where the drinking water naturally contains fluorides in concentrations as high as or higher than that recommended for dental health. (1) * Many studies have been conducted among these people by competent investigators and the search has been painstaking, yet no one has been able to find any adverse physiological effect except an enamel defect known as dental fluorosis and then only in areas where the fluoride concentration is too high (over 1 p.p.m.).

Every national health body in the United States that speaks with authority on the benefits and safety of fluoridation has adopted policies favorable to the measure. A joint statement has been issued by the American Medical Association's Council on Pharmacy and Chemistry and the Council on Foods and Nutrition, stating that there is no evidence of toxicity which should raise any question against the fluoridation of public water supplies.
(2) *

Other national health organizations that have endorsed fluoridation include: American Dental Association, American Association of Public Health Dentists, American Public Health Association, State and Territorial Dental Health Directors, State and Territorial Health Officers Association, U. S. Public Health Service, National Research Council, American Hospital Association and American Nurses' Association.

"There is no evidence whatever that it is in any way harmful in the doses required for the prevention of dental caries."
(3) *

* Numbers in parentheses correspond to references on page 26 et seq.

"The evidence as a whole is consistent in offering assurance that bringing the fluoride concentration in communal water supplies to that known to be optimal for dental health is a prophylactic public health procedure which has an ample margin of safety." (4)

"In the opinion of both councils the addition of one part per million of fluoride to drinking water under approved methods of control is harmless." (2)

"More than one million persons use water naturally containing 1.0 to 1.5 p.p.m. Fluorine. More than nine hundred thousand use water containing 1.6 to 2.0 p.p.m. F. More than six hundred thousand use water containing 2.1 to 3.0 p.p.m. F. More than one hundred thousand use water containing 3.1 to 5.0 p.p.m. F. More than forty thousand people use water containing 5.1 or more p.p.m. F. There have been no reports of deleterious effects other than dental fluorosis from any area using fluoridated water." (5)

"No harmful effects have resulted from fluoridation when the recommended fluoride concentrations are maintained. No ill effects upon humans have been observed. Neither have bad effects been reported by bottlers, brewers, bakers, launderers, gardeners, or industrial users of water." (6)

"It must be emphasized and reiterated that whether or not fluorine is toxic depends on its concentration: 1 p.p.m. is well below the level of toxicity." (7)

"Research into the toxicology of fluorine compounds has been continuous, and the possibility that continued low-level consumption of fluoride might eventually cause undesirable effects has been recognized for many years. This research and awareness has been stimulated by keen scientific and public interest and by not a little controversy. Yet, no definite evidence has been forthcoming that the continued consumption of fluorides at a level of about 1 p.p.m. is in any way harmful to health. This is an impressive fact and one which, in our opinion, makes it quite certain that if any untoward effect is revealed by future research it will be of a relatively trivial order." (8)

"We have found no scientific evidence that there is any danger to health from the continued consumption of water containing fluorides in low concentration. In the areas where naturally occurring fluorides are present at a level of 1.0 p.p.m. mortality statistics do not indicate any hazard due to fluorides and medical experience in such areas has not produced any evidence of increased morbidity. Many suggestions have been made that certain ill-effects may nevertheless occur. We can only comment that the proving of a negative is extremely difficult. Meanwhile, we are impressed by the fact that millions of people are living in ordinary good health on waters containing fluorides at levels of 1 p.p.m. or more." (8)

2. FLUORIDES ARE USED BY INDUSTRY AS HARDENING AGENTS AND WILL ALSO CAUSE HARDENING OF THE ARTERIES.

This conclusion is based on a misunderstanding, in fact, a complete lack of understanding of the pharmacological and physiological action of fluorides. (9) The word "hardening" as it applies in industry is entirely different when applied to the physiological process of calcification of the arteries.

3. FLUORIDES CAUSE OR ACCELERATE THE GROWTH OF CANCER.

This statement has been made as a result of wide publicity given to a mouse cancer experiment conducted by a biochemist at the University of Texas. A report in the Texas Dental Journal in September 1951 showed (10) that while the biochemist was feeding forty-four one hundredths of a part per million fluorine, he was unintentionally giving an additional 42 p.p.m. fluorine that was contained in the dog chow, the exclusive diet of the mice. Moreover, it was noted that the mice used in the experiment were a special strain, highly inbred for susceptibility to mammary tumors. Approximately 96%-100% of these mice eventually succumb to mammary tumors regardless of the diet and the water.

Two authorities from the United States Public Health Service visited the University of Texas and investigated the experimental work of the biochemist. They reported that there was no evidence that would contra-indicate the recommendation for the fluoridation of public water supplies.

Additional information on this subject is provided in the records of bureaus of vital statistics in various States. The statistics indicate that cancer rates are lower in States where there are many fluoride endemic areas than in States where the waters are fluoride free. (10,11) There is no reason to believe, however, that these lower cancer rates are due to the presence of fluorides in drinking water.

"Public controversy in the United States has caused several other types of possible hazard to receive close attention. One of the most widely publicized was a report from the University of Texas, that water containing fluorides at a level of 1 p.p.m. favoured the development of cancer among mice. This work has several serious technical flaws, and was publicly disclaimed by the Vice-President of the Medical Branch, University of Texas. So far as human cancer is concerned, there is no evidence that the presence of fluoride in the public water supplies has any harmful effect." (8)

4. FLUORIDES CAUSE AN UNSIGHTLY STAINING OF THE TEETH.

It is a well known fact that high concentrations of fluorides found naturally in public water supplies cause a condition known as dental fluorosis, often called mottled enamel. In such areas, the degree of dental fluorosis may be such that the dental enamel readily picks up stains which discolor the teeth.

Where the drinking water contains a concentration of 1 p.p.m. fluorine, there is evidence of a very mild degree of dental fluorosis in less than 10% of children using such water; (12) however, this degree of dental fluorosis does not cause staining. It can be detected only by dentists with special training and experience in recognizing such slight degrees as are present. In fact, many dentists believe that the amount of so-called mottling associated with 1 p.p.m. fluorine in drinking water in most parts of the United States actually enhances the beauty of the teeth. (13,14)

The advantage of fluoridation is that the amount of fluorides in the water can be controlled to a point where staining of the teeth does not occur but at the same time provides for the development of decay-resistant teeth.

"Thus water containing only 1 p.p.m. of fluoride causes no more than questionable or very mild mottling, that is, only an occasional white fleck, a spot in the enamel, and even then in only 10 per cent of the population. Such white flecks are so inconspicuous that they can be detected only by expert examination, and to demonstrate them photographically polarized light must be used.

"It is unfortunate that some term other than 'fluorosis' has not been found to describe this condition as the name implies a defect. We consider such small changes on the enamel surface, changes which may occur also from some other cause and are detectable only by a trained observer, cannot be considered a disadvantage even aesthetically." (8)

5. EVEN 1 P.P.M. FLUORINE IN WATER CAUSES STAINING OF TEETH IN SOME PARTS OF THE COUNTRY.

Because water intake varies to a significant extent in relation to climate and humidity factors, health authorities recommend that the concentration of fluorine in public water supplies be adjusted accordingly. (16,36) The amount of fluorine required in hot, dry climates may be less than 1 p.p.m., and in other areas a little more than 1 p.p.m. may be required for optimum benefits. However, for the majority of communities in the United States, a concentration of 1 p.p.m. is generally recommended.

The amount of fluorides necessary to control caries in any region would always be less than that which would cause staining.

H. C. Hodge, Professor of Pharmacology, University of Rochester, after careful analysis of the data accumulated from the examination of more than 5800 children in 22 cities where mottled enamel is common, concluded that where water contains 1 p.p.m. of fluorine a few children will develop very mild mottling of the teeth. He describes it thus:

"This will be so mild that dentists not specially trained to recognize mild mottling will not see it. Tiny, milky areas, particularly on the cusps of the molars, may be found by expert examiners. This very mild mottling will not be disfiguring.

"In Marshall Texas, the water is fluoridated at 1 p.p.m. Marshall is in the southernmost State, and has a much higher average daily temperature and a greater degree of humidity than any of the other study areas. It was anticipated that water consumption would be much greater than in the temperate areas so that the intake of fluorides would be considerably more. This may be so, but the effect on the teeth did not appear to be different from that noted in the other study areas." (8)

"Fluoride concentration should be adjusted to climatic conditions, one to 1.2 p.p.m. of fluoride may be considered optimum in zones comparable to the Great Lakes area, whereas 0.6 p.p.m. may be considered equally effective in areas similar to Southern Arizona." (42)

6. FLUORIDES ADDED TO PUBLIC WATER SUPPLIES WILL DO UNTOLD DAMAGE TO THE INTERNAL ORGANS OF ADULTS.

Persons who raise such "warnings" have no foundation in fact on which to base their premise. (9,12,15,17,23,39,40,41) Those who make unsubstantiated statements on harmful effects cannot support their contentions by scientific evidence.

"The question might be raised as to the concentration of fluorides. For example, if fruit and vegetables are sprayed with a fluoride insecticide and if they are cooked in fluoride water (1 p.p.m.) in which the fluoride content is increased by evaporation of the water, and if the patient is drinking 1 p.p.m. fluoride water and taking fluorine vitamin tablets containing 1 m.g. of fluorine and using a fluorine dentifrice, would all of these sources of fluoride combine to exceed the limit of safety from crippling fluorosis? The answer in our opinion is negative. It is almost impossible to imagine any set of circumstances in which fluoride intake might become sufficient to bring about a chronic high grade fluorosis if the fluorine content of the water is of the order of 1 p.p.m." (17)

"If a risk exists at all, it is so inconspicuous that it has not been revealed by many years of investigation. Millions of people are living in ordinary good health on water containing fluoride in the amounts recommended for caries control (or more), so that the fluoridation of other waters involves no new experience in human welfare." (8)

7. FLUORIDES CUMULATING IN THE BODY WILL HAVE A HARMFUL EFFECT ON THE KIDNEYS OF ADULTS.

A review of the vital statistics available from the Wisconsin State Board of Health reveals no differences in the data on nephritis in different cities with varying amounts of fluorides in their public water supplies. (18)

It is estimated that the amount of fluorine ingested daily through drinking water containing 1 p.p.m. fluorine is from 0.5 to 1.0 m.g. (19) It has also been shown that when the total amount of fluorine ingested by adults does not exceed 4.0 to 5.0 m.g. daily, its elimination in the urine, perspiration and fecal excretion is virtually complete. (20) The ability of the body to handle fluorides, then, is more than adequate for the amount ingested through fluoridated water.

"It is worth noting that atypical clinical effects among cases of nephritis in areas where the water contains natural fluoride even in concentrations above 1 p.p.m. have not been established." (8)

8. FLUORIDATION MAY AGGRAVATE THE SKIN CONDITION KNOWN AS "ACNE."

Because fluorine bears a close chemical relationship to bromine and iodine, there has been some fear expressed that fluorides would aggravate acne. This fear has been dissipated, however, by the results of tests reported by Dr. Ervin Epstein, (21), Assistant Clinical Professor of Medicine in the Division of Dermatology of the Stanford School of Medicine, San Francisco. Dr. Epstein has published results of tests conducted on 40 acne patients in which no difference was found in the rate of improvement between the patients who took prescribed fluoride tablets and those who did not.

9. FLUORIDES IN THE WATER MAKE BONES BRITTLE.

A detailed study of 1458 high school boys in 7 cities with varying concentrations of fluorides in the public water supplies showed no effect on bone fracture experience. (22) A radiologic survey at Bartlett, Texas, where the water contains 8 p.p.m. revealed an increased bone density in 11% of those examined. However, this condition was not associated with functional impairment. (23) X-ray examinations of persons living in areas where the water contains from 1.2 to 3 p.p.m. fluorine revealed no evidence of bone fluorosis. (24)

"It is well known that radiological changes can occur in the spine and other bones among workers exposed to dust containing high concentrations of fluoride, though disability is not common even among men who have been so exposed for many years. We were unable to find any evidence pointing to the existence of skeletal abnormalities among populations using water supplies containing fluoride at the levels recommended for the control of caries." (8)

"In the Newburgh-Kingston study, radiographs of children have been studied by an independent expert who did not know which group the cases came from, with negative results. Studies of fracture incidence and of growth have been made, and no relation to exposure to fluorides has been found." (8)

10. FLUORIDES WEAKEN THE BONES OF CATTLE.

It has been reported that in some industrial areas, fluoride-bearing dust from some manufacturing plants has laid a heavy coating of the material over nearby pasture lands. Cattle grazing in these areas have, therefore, consumed large quantities of fluorides and have suffered ill effects. Dust control measures have been taken to prevent further such occurrences. It is dangerously misleading, however, to compare the effects of very high concentrations of fluorides with the minute amounts in public water supplies in the ratio of one part per million.

11. FLUORINE IS A POISONOUS SUBSTANCE FOUND IN RAT POISON AND INSECTICIDES.

This assertion is true, but the inference that the same substance in minute concentration in drinking water has the same effect as fluorine in high concentrations is completely incorrect. Many substances in common use by human beings are beneficial when used in proper amounts but may be harmful when used improperly. For example, chlorine is used also in most public drinking waters in the United States. Sodium is a highly reactive substance and dangerous to handle, and chlorine is also a poisonous gas, yet both elements are found daily on our tables in the form of sodium chloride, or ordinary table salt. Fluorine is a constituent of many foods in common use.

12. FLUORIDES ARE A BY-PRODUCT OF ALUMINUM, A HARMFUL MATERIAL USED FOR COOKING UTENSILS.

It has long since been demonstrated that the use of aluminum cooking utensils has no bearing on health. Moreover, fluoride compounds used for water fluoridation are not a by-product of aluminum plants. The Aluminum Company of America does produce

sodium fluoride, but in a special plant, in the same manner as it is produced by others not in the aluminum industry. (37)

13. FLUORIDE IN WATER WILL HAVE AN INJURIOUS EFFECT ON FOOD PROCESSING.

The American Baking Institute conducted a study in 1950 and reported, "The addition of fluoride ion in concentrations up to 10 p.p.m. in the sponge and dough water has no effect upon bread quality. Bakers in communities that plan to incorporate fluorine in the city water supplies as part of a program to reduce the incidence of dental caries should anticipate no difficulties in using such water for bread production." (43)

"It is reported that Green Bay and Kaukauna, Wisconsin have some of the largest cheese plants in the world. Green Bay's water supply contains 2.5 p.p.m. fluorine and Kaukauna's water has 1.8 p.p.m. fluorine." (44)

"It is also reported that Milwaukee Breweries used deep well water containing as high as 1.8 p.p.m. fluorine before the city began to use lake water. The following cities in Wisconsin have brewing industries and use water containing fluorides either in controlled amounts of about 1 p.p.m. or incidentally occurring at 2 and 3 p.p.m.: Rhinelander, Beaver Dam, Sheboygan, Columbus, Madison, Oshkosh, Green Bay, de Pere and Allouez." (44)

14. FLUORIDATION SHOULD BE PUT TO A REFERENDUM VOTE FOR ALL THE PEOPLE IN THE CITY TO DECIDE.

No one will argue the right of citizens to have an opportunity to vote on any matter which requires such action. It has been traditional in this country, however, to delegate certain responsibilities requiring technical skill and professional knowledge to employed or elected representatives of the citizens.

A very difficult and expensive program is required in order to inform all the people in a community regarding a rather highly scientific subject sufficiently enough to enable every person to vote intelligently. If, therefore, a city council is unwilling to assume the responsibility of making a decision on a technical subject and submits the issue to a referendum, a heavy responsibility is placed on civic and professional groups to provide for an adequate public information program through which all citizens will be scientifically and accurately informed.

15. FLUORIDATION ONLY BENEFITS CHILDREN.

It is true that in the beginning of a fluoridation program,

the greatest benefits will accrue to the younger children; however, as these children become adults, they will continue to benefit and eventually the entire continuous-resident population of the community will be receiving full benefits from fluoridation. Studies conducted among adults in fluoride areas show that the dental benefits continue throughout life. (25)

".... Studies in this country ... and in America ... have shown that the beneficial effect is carried into adult life, at least up to the age of 45, but further investigations in the higher age groups are needed." (8)

16. FLUORIDATION IS STILL IN THE EXPERIMENTAL STAGE.

There is not one public health measure in use in this country today in which all research possibilities have been exhausted. Doubtless, as time goes on, finer details will become known that may even more greatly enhance the value of fluoridation. This does not mean, however, that we have not reached the stage where fluoridation can be undertaken with assurance of its safety and benefits.

Studies begun in 1945 show that a similar degree of protection against dental caries is found in fluoridated areas as is found in areas where the same fluoride concentrations occur naturally. Statistical data show a significant reduction of dental caries in children and there is evidence to suggest some protection also to the teeth of persons who were young adults before they began drinking fluoridated water. Continued observations will establish the ultimate degree of effectiveness in older age groups who used fluoridated water during childhood.

Statements have been made that fluorine may not be the effective element, that some concomitant element may be the effective factor. Animal studies and controlled fluoridation studies demonstrate that fluorine is the one element consistently associated with the caries reduction.

It is quite true that the original studies on controlled fluoridation undertaken in several cities will not be completed for at least another two years. But there are now 9 (nearly 10) years of success and the question of safety has been answered satisfactorily and amply from the evidence obtained in the areas where fluoridation has been undertaken on a controlled basis and the evidence from areas where the water has for generations contained fluorine.

That controlled fluoridation in the amount of 1 p.p.m. will reduce dramatically the incidence of dental caries in children without harmful effect upon humans or adverse effect upon commercial or industrial processes is firmly established. It is clear that the protection acquired in childhood is permanent and that ultimately the entire population will benefit. It is established that the cost of the procedure is small and the economic saving

in cost of dental care is great. Whether or not deliberately controlled fluoridation will give the same measure of caries protection as uncontrolled fluoridation of water as it naturally occurs in so many areas will not be answered fully until permanent dentition is complete for children born at the time of commencement of controlled fluoridation. This is the factor that determines the long period chosen for the study projects. The indications up to now are that just as much protection will be obtained by controlled fluoridation as has resulted from the fortunate accident of having a water supply with the same amount of fluorine already present. Each year a closer approach to the degree of benefit in caries protection conferred by the fortunate accident is attained in the study areas so that now the children in these areas have almost an equal advantage over children not receiving water containing fluorides as have children reared where the water has always contained an adequate amount of fluorine. No one has suffered harm from fluorine in the water either in the study areas or in areas where it is naturally found in like small amount.

17. THE FLUORIDATION EXPERIMENT DOES NOT ADHERE TO THE 10 STANDARDS SET UP BY THE NUREMBURG WAR CRIMES TRIBUNAL FOR EXPERIMENTATION ON THE LIVES OF HUMAN BEINGS.

Such a statement and the newspaper articles that have been built around it are based upon an incorrect assumption.

It is obvious that, in the sense in which the writer of these articles used the term, the fluoridation of public water supplies definitely cannot be considered "experimental." Fluoridation is not an experiment on the lives of human beings. If fluoridation is to be considered as an "experiment" in this sense, then for generations more than 4,000,000 people in the United States have been living as an "experiment" all their lives in areas supplied by water with fluoride concentrations as high as or even higher than that recommended for the development of decay-resistant teeth.

18. ARTIFICIAL FLUORIDATION MAY NOT PRODUCE THE SAME RESULTS AS DO NATURAL FLUORIDES.

Actually, there is no such thing as "artificial fluoridation." Fluorides are always added to water, generally being picked up by the water running through underground passages and crevices where the ground contains various fluoride compounds. In this process, man has no control over the concentration. Studies show that the same results occur whether the fluoride is added in controlled amounts or whether added happenstance by nature, except that safety is assured when the fluoride is added in controlled amounts.

"There is nothing to suggest that a water containing fluoride, naturally derived, has properties different from those of water to which fluoride has been added." (8)

"There is no essential difference between fluoride which occurs naturally in water and that which is added to water in the process of fluoridation and the action on the teeth is therefore similar. This is borne out by the fact that the data already available shows complete parallelism in the dental condition of 6-year old children living in natural fluoride areas and in those who live in fluoridated areas where the fluoride levels are similar." (8)

19. FLUORIDES BLOCK RATHER THAN AID CALCIFICATION WHEN MAGNESIUM IS ALSO PRESENT IN THE WATER SUPPLY.

The author of this theory, Dr. A. E. Sobel, is in agreement with a statement made by a U. S. Public Health Service researcher to the effect that there is no justification for concern regarding a detrimental effect of magnesium on the caries preventive effects of fluoridation. Dr. Sobel's test tube findings have not been duplicated in animal or human experience and provide no evidence that magnesium has any influence on the beneficial effect of fluorides. (26)

20. ONE COULD JUST AS WELL ADD FLUORIDE TO TABLE SALT, MILK, BREAD OR SOME OTHER FOODSTUFF.

Fluoride is a natural constituent of many water supplies. The discovery that fluoride ingested in proper amounts reduced tooth decay was the result of work in towns where the supplies contained fluorides naturally. Water, therefore, is a natural medium for caries control. It is impractical to add fluoride to table salt because it is not uniformly consumed and because the use of salt with a common fluoride content would be hazardous in view of the widely varying natural fluoride content of water supplies. Practical difficulties of a similar type would hamper the "fluoridation" of milk and bread. For example, control testing would be difficult and responsibility for the procedure would be divided. (27, 28)

Fluoridation of the public water supply is especially practical and safe because it is constantly subject to control by competent health authorities and does not require action on the part of individual citizens. (29)

"The answer is that all epidemiological work has been concerned with fluorides in water and it is not known with certainty that fluorides otherwise administered would have similar effects. Of equal importance is the fact that additions of fluoride to milk, as has been suggested, would be impossible to control in the actual

addition or in the amounts consumed by the child. Similar arguments apply to the addition of fluoride to table salt or other commodity. The wastage of fluoride added to water supplies is not serious and is insignificant in view of the benefits to be expected." (8)

21. IT IS WASTEFUL TO FLUORIDATE ALL THE WATER WHEN ONLY SUCH A SMALL AMOUNT OF IT IS USED FOR DRINKING PURPOSES.

Chlorinated water is used also for watering lawns, washing cars and for most industrial purposes, yet it has been found much more practical to chlorinate the entire water supply than to have separate water systems. The same is true of water fluoridation. It is particularly true in view of the fact that the annual cost per person will range from 5 - 14 cents, and this amount covers fluoridation of all the water, not just that used for drinking purposes.

22. COSTS ARE GOING UP ALL THE TIME, AND THE CITY CAN'T AFFORD TO ADD ANOTHER ITEM TO ITS BUDGET.

This statement might more correctly be stated, "The citizens can hardly afford the luxury of going without fluoridated water." Experience in more than 200 communities in the United States has demonstrated that fluoridation is an inexpensive procedure. The cost varies in different cities, but averages about a dime a year per person, often less than the cost of an ice cream cone. Fluoridation will reduce future dental bills for fillings, extractions and replacements. The cost of an average filling will pay for fluoride for one person for about 30 years. (30,31)

23. FLUORIDATION HAS NOT BEEN "RECOMMENDED" BY THE AMERICAN WATER WORKS ASSOCIATION.

The water works engineer is not in a technical position to recommend fluoridation. Such recommendations are the prerogatives of the dental, medical and public health groups. The American Water Works Association has stated, however, that the water works industry is willing and ready to follow through when the proper authorities recommend or approve the treatment. (28)

24. FLUORIDATION CONSTITUTES A RESTRICTION OF RELIGIOUS FREEDOM.

Some people maintain that the free exercise of their religion is hampered by introducing fluorides in community water supplies. This contention is based upon the supposition that the addition

of fluorides to water converts the mixture into a medication. Even if fluoridation could be considered medication, precedents in interpretation of the "Freedom of Worship" clause of the First Amendment of the Constitution of the United States demonstrate that the right of a special group to engage in a practice of its religion must not unreasonably interfere with the right of the community as a whole to enjoy what it determines as beneficial for its physical well-being.

25. THE FLUORIDATION OF PUBLIC WATER SUPPLIES CONSTITUTES MASS MEDICATION.

The generally accepted definition of medication as used by dentists and physicians refers to the administration of remedies to treat or cure a given condition. (38) Fluoridation does not constitute a remedy; it does not treat an existing disease. Fluoridation supplies a normal constituent found in human teeth, and makes fluorine available in the proper amounts through a natural source for the development of decay-resistant teeth.

Fluoride, like calcium, phosphorous, is a natural constituent of teeth and bones and must be supplied to the body through food or drink in order to produce normal calcified structures. Fluorides in the public water supply are no more a medication than are other substances normally found in water or than the various constituents of food necessary for the maintenance of health. Adding sodium fluoride to the water supply is no more a medication than adding table salt or other materials to food to make it palatable and healthful; nor the addition of chlorine to the public water supply for the prevention of enteric diseases.

Under the definition in the Food and Drugs Act, 1920, Statutes of Canada, fluorine added to water can be interpreted in a legal sense as a food.

"Food includes every article used for food or drink by man, and every ingredient intended for mixing with the food or drink of man for any purpose whatever."

The water of Lake Ontario already contains 0.1 p.p.m. fluorine, i.e., one-tenth of the amount considered necessary for optimal benefit.

26. FLUORIDATION CONSTITUTES SOCIALIZED MEDICINE.

As is pointed out in section 25, fluoridation is not medication or a form of "medicine." Fluoridation is no more "socialized" than is chlorination or other measures employed by the community for the prevention of disease. In fact, fluoridation represents one of the most realistic arguments against "socialized medicine" inasmuch as it is a preventive measure and is a project which communities determine and provide for themselves.

27. FLUORIDATION IS COMPULSORY MEDICATION IN THAT EVERYONE IS COMPELLED TO DRINK THE FLUORIDATED WATER.

Again, referring to section 25 of this report, fluoridation is not medication. Fluoridation does not mean compulsion on the part of individuals any more than does the use of other community resources, including chlorinated water. People form communities so that they can share such common public services as the schools, fire departments, water supplies and libraries. If a separate group in the community wants a school that is different than that chosen by the majority, then it establishes its own. One group does not impose its convictions on the whole community. The same principle applies equally to the water supply. Fluoridation is not compulsory mass medication any more than is the iodization of table salt or the enrichment of flour.

28. AN ACCIDENT IN THE WATER PLANT MIGHT CAUSE OVER-DOSAGE AND SEVERE HARMFUL EFFECTS.

Acute morbidity manifested by increased salivation and vomiting, may be caused by ingesting 0.25 g. sodium fluoride. This quantity in an 8-oz. glass of water represents 1,000 p.p.m. sodium fluoride, or about 450 p.p.m. fluorine. To obtain this concentration, it would require more than four tons of sodium fluoride per million gals. of water processed which is obviously not possible in a program of water fluoridation, even if gross negligence occurred. (27)

"It should be realized that the level of fluoride in the water supplied would need to rise greatly before danger of acute fluoride poisoning resulted. The accidental delivery of water containing even 10 times the normal fluoride concentration for a matter of a few hours would be unlikely on known evidence, to have any undesirable results." (8)

29. THROUGH JUST ONE TWIST OF A VALVE, AN ENEMY COULD FLOOD THE CITY WITH POISONOUS FLUORIDES AND KILL OFF THE WHOLE POPULATION.

This statement has appeared in several newspapers. See answer to statement, number 28. It seems hardly possible that saboteurs would attempt to rely on tons of sodium fluoride when one ounce of botulinus toxin in a reservoir of water would have much greater effect.

"The high dosage necessary for acute fluoride poisoning could not be obtained as a result of accidental or deliberate over-fluoridation of water supplies. In order to obtain acute toxic effects it would be necessary to dump approximately eight tons of

sodium fluoride into the Brantford water supply in one day." (32)

"With a correctly designed plant and proper controls there is no danger of adding a toxic overdose of fluoride." (8)

30. THERE MAY BE INDIVIDUAL VARIATIONS IN THE AMOUNT OF WATER CONSUMED DAILY AND IN THE REACTION OF DIFFERENT INDIVIDUALS TO FLUORIDES.

Individual variations are no greater in areas where the water contains controlled amounts of fluorine than where there is naturally 1 p.p.m. fluorine in the water supply. In such communities there is no mottled enamel of aesthetic consequence, and it has been demonstrated that there are no harmful effects; yet these communities, too, have people who vary in their water intake and in their physiological reaction to all substances. (33) The optimum level has been established after extensive experience with its effect on humans.

31. FLUORIDATION WILL PRESENT MANY DIFFICULT ENGINEERING PROBLEMS.

Water works operators have found through experience in more than 200 communities that the addition of fluorides to a municipal water supply is practical from an engineering standpoint. The mechanics of fluoridation are no more involved than those of water purification; moreover, the machinery and equipment commonly used in water plants is easily adapted. (16, 30) The community's desire for fluoridation may be used as a "lever" to get other needed improvements made in the water plant, but the institution of a fluoridation program should not be made dependent on improvements that are not required for effective fluoridation.

"The addition of chemical to a water used for domestic purposes, whether it be chlorine for disinfection or alum for flocculation, requires precision apparatus; mistakes resulting in over or under dosage are not tolerated either by the water authorities or the consumers. Suitable equipment, therefore, has been developed in this country and elsewhere for the treatment of water and the acceptance of a drinking water as a matter of course by the public is a testimony to the efficiency of the treatment plant. The equipment used in the United States for the fluoridation of water supplies is similar to that commonly used in established water treatment practices and the controlled addition of fluoride presents few difficulties that have not already been met and overcome." (8)

"The larger water undertakings use dry feeders with either sodium fluoride or sodium silicofluoride. These feeders deliver a definite amount of the dry chemical, in a unit of time, to a solution tank. The solution of the chemical is then either pumped or fed by gravity into the main water supply. We were impressed

with the accuracy of these dry feeders, particularly of the gravimetric type, which often have devices to give instant visible and audible warning of any variation from the desired rate of feed." (8)

32. ADDING FLUORIDES TO WATER MAY PRESENT A HAZARD TO WORKERS IN THE WATER PLANTS.

Considerable attention has been given to the possible hazard to plant operators handling fluoride compounds and inhaling fluoride dust. To counteract this potential danger proper precautions are taken by providing operators with masks and gloves to use when filling the fluoride feeders and by providing exhaust systems in the larger plants. Water plant operators state that no serious operating problems are encountered in the plant and that, under proper precautions, fluoridation appears to be no more hazardous to the operating personnel than is chlorination. (16, 34)

"The handling of these chemicals, provided simple precautions are taken, is not hazardous and we did not find any evidence of even minor harmful effects on water works operators who control large quantities of fluoride salts." (8)

33. THE CITY WILL BE HELD LIABLE FOR SUIT IF SOMEONE CLAIMS THEY ARE HARMED BY FLUORIDATION.

The opinion of the Attorney General of Michigan (1944) on this subject seems to be typical of the judicial opinion in most States regarding the liability of the owner of a public water supply; (35) "A water supply corporation is bound to use reasonable care and diligence in producing pure and wholesome water that is at all time free from any infection or contamination which renders the water unsafe and dangerous to individuals, or unsuitable for domestic purposes, and is liable for injury resulting from its failure to do so.

"The same rule is generally held applicable to municipal corporations. Before liability could be established it would be necessary that the plaintiff show negligence on the part of the utility or municipality furnishing the water and show that his injuries resulted from such negligence." (28)

34. FLUORINE CAUSES AN INCREASE IN DEATHS FROM HEART DISEASE.

Statistical data for Grand Rapids, Michigan, designed to establish this claim as fact were given by Representative A. L. Miller of Nebraska in the U. S. Congress. The figures given, although grossly inaccurate, have been quoted repeatedly by persons opposed to fluoridation. See the comment by Dr. Prothro, Public

Health Director, Grand Rapids, which is given in part 11 of this report, Page 43.

Graphs have been produced to show a marked increase in deaths from heart disease (all causes) and from diseases of the coronary arteries in Brantford, following fluoridation of the water. If the graphs had been constructed properly and if they had been extended to cover the years 1944 to 1950 and not just 1945 to 1949, it would be seen that there is no relationship between deaths from heart disease or deaths from diseases of the coronary arteries and fluoridation of the water. This is further emphasized by showing on the graphs the data for another city of comparable size where there is no fluoride in the water (Kingston, Ontario). See appendix on Page 25.

35. NOT ALL ATTEMPTS AT REDUCING TOOTH DECAY BY FLUORIDATION HAVE BEEN SUCCESSFUL.

Every year in every centre where controlled fluoridation has been introduced, there is a progressive decline in the incidence of dental decay. In those centres where fluoridation has been in operation as long as eight years, the benefit to the child population has reached almost the same degree as is found in areas having naturally fluoridated water in the extent of 1 p.p.m.

"In all the studies a steady reduction in caries experience has been found in control cities, no comparable reduction at any age was observed, so the possibility that a change would have occurred without fluoridation in the study areas can be eliminated."
(8)

36. FLUORIDATION WILL ADVERSELY AFFECT THE MANUFACTURING OF ICE.

The only problem reported in industry to date was at Charlotte, N.C., where cracking of artificial ice was attributed to fluoridation. The local water supply is soft and has a low alkalinity. By using methods available to the ice industry, the problem was entirely eliminated. Artificial plants in other cities have not experienced similar difficulties. (28)

37. FLUORINE IS A CUMULATIVE POISON AND WHILE 1 P.P.M. IN WATER MAY BE TOO SMALL TO HAVE A CUMULATIVE EFFECT, THERE IS A GREAT RISK OF ADDING MORE THAN THIS AMOUNT WITH SERIOUS CONSEQUENCES.

The level of 1 p.p.m. is well below the amount of fluorine which would cause any trouble. Moreover the control of the addition of fluoride to water is so simple and so positive that there is no danger of overdosing. The amount added can be controlled.

to within 5% of the desired level. This means that aiming at 1 p.p.m. the possible variation in level obtained will be from 0.95 to 1.05 p.p.m. Such a variation is insignificant.

" No evidence of overdosage was detected in an examination of the records of the 19 water plants we visited in the United States. These plants ranged in size from that servicing a population of 735 and maintained by the local handy-man to one under the control of a fully qualified staff which is supplying over 20 million gals. of water daily to 280,000 people." (8)

38. THERE ARE OTHER AND BETTER WAYS OF PREVENTING TOOTH DECAY THAN FLUORIDATION

Proper nutrition and good mouth hygiene as a means of preventing tooth decay has been, is and probably always will be, advocated by medical, dental and public health authorities. Fluoridation is not a substitute. There is growing evidence that proper nutrition demands a daily intake of fluorine, which is not likely to be obtained unless it be present in the water consumed. The adoption of fluoridation is counted as a means of furthering proper nutrition. Fluoridation is the cheapest way of preventing about 65% of the tooth decay that now occurs, and it is the only procedure that will reach all people in a community.

"A comparison of English and American findings suggests that for the best dental results, especially among adults, a combination of fluoridation and a high standard of conservative dentistry is needed." (8)

39. FLUORIDES CAUSE AN INCREASE IN PERIODONTAL DISEASE.

"Russell and Elvove (1951) have compiled data from examinations dealing with periodontal disease in Boulder, Colorado (a non-fluoride area) and Colorado Springs (2.5 p.p.m. of fluoride in the water). The age groups studied were 20 to 44 years. The condition of the gingival tissues was assessed in detail and tooth mortality rates due to periodontal diseases were calculated. No differences were reported in respect to gingival tissues. Tooth loss from periodontal disease averaged 0.72 teeth per individual in the non-fluoride area and only 0.29 teeth per individual in the fluoride area. Fewer teeth are lost from caries and hence more teeth are exposed to the risk of periodontal disease in a fluoride area. There is no evidence of any increased incidence of periodontal disease associated with fluoridation of water." (32)

40. FLUORINE IS SO TOXIC THAT EVEN AT 1 P.P.M. IN THE WATER THERE IS A DANGER OF ACUTE POISONING AND POSSIBLY DEATH IN PEOPLE TAKING TOO MUCH WATER.

In human self-experimentation as much as 250 mgm. of sodium fluoride has been taken at one time without harm.

To obtain 250 mgm. at one time through drinking water containing 1 p.p.m. of fluorine, one would have to drink over 60 gallons (imperial).

41. THERE IS NOT UNANIMITY OF OPINION IN THE MEDICAL AND DENTAL PROFESSION ON THE QUESTION OF FLUORIDATION OF WATER.

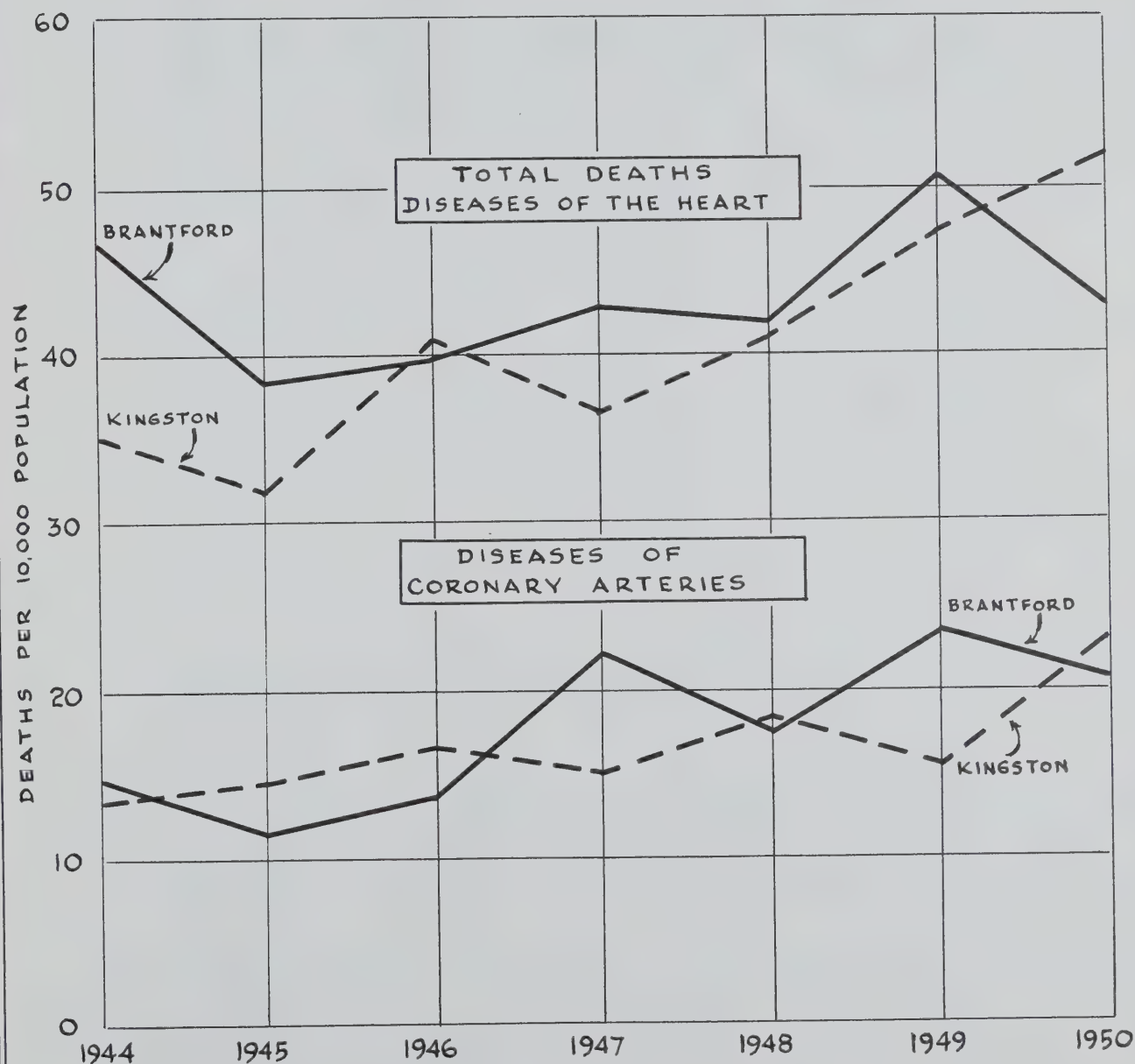
A few scientists qualified to express an authoritative opinion have, as individuals, voiced caution and still fewer have opposed fluoridation. However, every major national health organization in the United States and Canada has endorsed fluoridation of public water supplies. See the list given on the first page of this report. To this list may be added;

- The American Medical Association
- The American Welfare Association
- The Inter-Association Committee on Health
- The Canadian Medical Association
- The Canadian Dental Association
- The Canadian Public Health Association
- The Ontario Public Health Association
- The Ontario Dental Association
- The Academy of Dentistry, Toronto
- The Commission on Chronic Illness, (U.S.A.)
- The Academy of Medicine, Toronto
- The Health League of Canada
- The Canadian Society of Dentistry for Children

42. THERE MAY BE PEOPLE PECULIARLY SENSITIVE OR SUSCEPTIBLE TO FLUORIDES SO THAT EVEN 1 P.P.M. IN WATER WILL HARM THEM WHILE NORMAL PEOPLE ARE UNAFFECTED.

This conjecture has been answered satisfactorily by consideration of the more than four million people in the U.S.A. who regularly all their lives have used water containing .7 to 5 or more p.p.m. In such a group there will be represented all manner and sorts of people including those who vary in their water intake and in their reaction to all substances - fluorine included. Greater susceptibility may account for the small percentage of people who develop mild mottling of the teeth at fluorine levels between 1 and 1.5 p.p.m. There is a complete lack of anything more serious than this mild mottling of the teeth being the result of susceptibility.

DEATH RATE FROM DISEASES OF THE HEART



KINGSTON - NO FLOURINE IN WATER.

BRANTFORD - 1 p.p.m. FLOURINE ADDED TO WATER SINCE 1945.

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PART II

THE PREVENTION OF DENTAL CARIES BY THE ADMINISTRATION
OF FLUORINE IN PUBLIC WATER-SUPPLIES

The ideal method of preventing a disease is first to find and then to remove its cause. Unfortunately we have no precise knowledge of the fundamental causes of dental caries; which may be the result of any or all of a number of influences. Members of the same family, reared under similar conditions of diet, oral hygiene, and general environment are sometimes at opposite extremes in their powers of resistance to caries. The comparative freedom of some more primitive races (Mellanby and Mellanby 1952) suggests that this infliction may be a product of the habits associated with what we are pleased to consider our advanced state of civilisation. In this state of uncertainty we cannot afford to neglect any measure that might help to control this distressing and almost universal disease.

I believe that there is a simple and inexpensive way of reducing the incidence of dental caries - namely, by supplementing the daily intake of fluorine in areas where this is insufficient. I also think that, in the existing state of our knowledge, the way to ensure the greatest benefit to the greatest possible number would be to add fluorine to public water-supplies. But before any responsible authority could support such a step, satisfactory answers must be found to the following questions:

- (1) How much benefit to the population may reasonably be expected?
- (2) What concentration of fluorine in the public water-supply will give sufficient benefit to justify its administration?
- (3) May this concentration reach the level at which the known harmful effects of fluorine become evident?
- (4) With what degree of accuracy can the dose of fluorine in the water be regulated? Can the desired dose be maintained with the certainty that it will never exceed the limit of safety?
- (5) Is the public water-supply the most suitable and most effective vehicle for fluorine?
- (6) What will be the cost?

The Evidence

Mottled Enamel

The dental dystrophy known as mottled enamel has probably

existed from earliest times, but it did not receive much attention until the work of Black and McKay (1916) was published. Black described a dental lesion which he found in 80% of the permanent residents of Colorado Springs in the U.S.A., but not in those who had moved there during adult life.....

McKay (1918) thought that mottled enamel was connected with the drinking of water from artesian wells.

Ainsworth (1928, 1933) reported mottled enamel in the inhabitants of Maldon in Essex. The condition did not affect those who lived more than 3 miles from Maldon, or who were born outside the area and moved to Maldon after the age of eight. Dental caries was less common than elsewhere in both deciduous and permanent teeth of the Maldon children, although the deciduous teeth were not mottled. Ainsworth thought that something affected the teeth during their development and caused the mottling, and that this something might be in the local water-supply. Both these suppositions have proved correct.

The relation between mottled enamel and water-supplies was perhaps most conclusively established by Kempf and McKay (1930).

The town of Bauxite in the U.S.A. was established in 1901, and the water-supply originally came from shallow wells and springs, but in 1909 a deep well was sunk, and the supply was later augmented by two other deep wells, the water being piped to the houses. The shallow wells were gradually abandoned. The authors found no evidence that mottled enamel had existed before the introduction of the deep-well water, and the oldest person with this defect had been born about the time this water came into use. This investigation was particularly convincing because the food-supply of the town came from a central store or from locally grown produce, and the diet of the affected people remained unchanged throughout. Moreover, children of all social classes, and therefore of all conditions of diet, were attacked equally, regardless of their physical condition, but children who lived outside Bauxite and who did not drink water from the new wells were not affected. Analysis of the water threw no light on the cause of the condition and, after studying the chemical composition of the waters previously examined by Black and McKay (1916), the authors came to the conclusion that the mineral content of waters in areas where mottled enamel was common could vary widely. They suggested that animal experiments might "indicate definitely whether the water carries some deleterious agent or lacks something necessary for the normal growth of the enamel."

Fluorine and Mottled Enamel

At this point in the story it was reasonable to infer that mottled enamel and caries resistance were caused by the same agent in the water; but what this was had not been established nor was it even suspected that the beneficial effects might be obtained without dental disfigurement.

McCollum et al. (1925) found that the dentition of rats was

improved by giving them a diet rich in fluorine, but that a dental dystrophy with yellow discoloration of the teeth also developed. It was not until six years later that three independent studies by Churchill, Smith et al., and Velu (quoted by Dean and Elvove 1935) demonstrated that fluorine was the cause of mottled enamel. The inference was justified that fluorine was also responsible for the increased resistance to dental caries which accompanied this condition.....

High-Fluorine Waters, Mottled Enamel, and Caries Resistance

Following the discoveries I have mentioned, extensive surveys were made in the U.S.A. to ascertain more precisely the relationship between mottled enamel, caries resistance, and fluorine in water - notably those of Trendley Dean and his co-workers (Dean 1933, 1938, Dean and Elvove 1935, 1937, Dean et al. 1934, 1935, 1939, 1941, 1942).

It is doubtful whether such a comprehensive investigation of the incidence, aetiology, and significance of any other condition has ever been made in so short a time. Largely as a result of these officially sponsored surveys it is now known that waters naturally containing the fluoride ion in concentrations of from 1 to 8 and even 10 p.p.m. have for long been in regular use for domestic and industrial purposes. It has been shown quite conclusively, particularly by Dean's series of over 7000 children, that the incidence of dental decay is inversely proportional to the fluorine content of the water-supply. Dean has shown, moreover, that a 50-65% reduction in the incidence of caries in school-children may be expected from concentrations of fluorine of between 1.0 and 1.5 p.p.m., a level that causes either no mottling of enamel or so slight a degree that it is noticeable only on expert examination. He also found that no further appreciable benefit was conferred by raising the fluorine content above this level. It is of interest to note that the maximum concentration he proposed is also the permissible limit of fluorine in potable water as laid down in "Drinking Water Standards 1946" (American Water Works Association 1946).....

Dean et al. (1935) classified mottling in six grades according to the degree present, and there can be no doubt that unless some such classification is adopted differences will exist in the observed incidence. I shall consider only the possibility of disfigurement and whether it will be sufficiently common or severe to offset the advantage of a substantial reduction in caries. It is safe to say on the evidence that this will not be the case if the water contains no more than 1.5 p.p.m. of fluorine. There is general agreement with Dean's finding that the maximum benefit without risk of disfigurement or other undesirable consequences may be expected at concentrations of between 1.0 and 1.5 p.p.m.....

Most of the knowledge gained has come from the examination of children, but Deatherage (1943) and McKay (1948) produced evidence that caries resistance once acquired may be permanent.....

Experimental Addition of Fluorine to Public Water-Supplies

The first large-scale experiment in prevention began at Grand Rapids, Michigan, in January, 1945, and later in the same year at Newburgh, New York, and Brantford, Ontario. The full results will not be known until they have been in progress for fifteen years or more - i.e., until the permanent teeth of children born since 1945 have erupted and been exposed for sufficiently long to the influences that cause decay. Nevertheless, the preliminary results leave little doubt that the protection given by naturally occurring fluorine is also conferred by waters to which it has been artificially added.....

At Grand Rapids the concentration of fluorine in the public water-supply was raised to 1.0 p.p.m. Maier (1950) compared the number of decayed, missing, and filled permanent teeth (D.M.F. teeth) in children of various ages in that town in the years 1944-45 and 1949-50 with similar figures in Aurora where the water has a natural fluorine content of 1.2 p.p.m. In 1944-45 D.M.F. teeth at Grand Rapids were more than twice as numerous as at Aurora, but by 1949-50, the figure for children up to seven years of age was very close to that at Aurora. Five years after the Grand Rapids experiment began Dean et al. (1950) found a reduction in D.M.F. teeth of 51.3% at six years of age, 36.4% at nine years, and 16.7% at thirteen years. There was also a slight and unexplained reduction in the low-fluorine control town of Muskegon.

In the Newburgh experiment the neighbouring town of Kingston, which has a low-fluorine water, was used as a control. In May, 1945, the fluorine level of the Newburgh supply was raised to 1.2 p.p.m. Four years later there had been a 32.5% reduction in the D.M.F. rate for children aged six to twelve, and an increase of 115% in the proportion of children aged five to six whose deciduous teeth were all free from caries (Ast et al. 1951). No signs of undesirable side-effects in the children have been found by regular physical and radio-logical examination, blood and urine analyses, and examination of the eyes and ears. Schlesinger et al. (1950) reported that no difference had been found between the children of Newburgh and the children of Kingston other than the diminished incidence of dental caries.....

.... the American Water Works Association (1949) said:

"In communities where a strong public demand has developed and the procedure has the full approval of the local medical and dental societies, the local state and health authorities and others responsible for the communal health, the water departments or companies may properly participate in a program of fluoridation of the public water supplies."

And later:

"Recommendations for water fluoridation are the prerogatives of the dental, medical and public health groups. When the proper authorities approve the treatment, it then becomes the function

of the water works utility and industry to follow through willingly and intelligently where proper controls are assured" (American Water Works Association 1951).

The American Dental Association (1950) said:

"The fluoridation of public water supplies as a partial protection against tooth decay is a tremendous step forward in the profession's fight against dental disease. In fact, the reports warrant the assumption that the fluoridation of drinking water may, at the end of ten years, reduce significantly the incidence of tooth decay ... and they should open the way for all communities having a central water system to provide a simple, inexpensive measure which will partially protect their children from the ravages of tooth decay."

The American Public Health Association (1951) declared that "accumulated evidence indicates a sound basis for the fluoridation of public water supplies for the partial control of dental caries" and that "this procedure be recommended as a safe and effective method for reducing the prevalence of dental caries."

In April, 1951, Surgeon-General Scheele of the Public Health Service said in testimony to the Senate sub-committee on appropriations:

"During the past year, our studies progressed to the point where we could announce an unqualified endorsement of the fluoridation of public water supplies as a mass procedure for reducing tooth decay by two-thirds."

Toxicity of Fluorine

The first lesions produced by prolonged small doses are the various degrees of mottling of the enamel. Weaver (1950) found that this may proceed to the stage of disfigurement if water containing 2.0 p.p.m. of fluorine is taken throughout the period of tooth development. Fortunately there is a wide margin between this dosage and the intake required to produce more serious lesions.....

A concentration of 1.0 p.p.m. of fluorine in water represents an intake in 1.5 litres of water (a somewhat high daily consumption) of 1.5 mg. of fluorine. McClure (1949) gives the average daily intake in food as 0.25-0.32 mg. which is in reasonable agreement with the findings of others. Machle et al. (1939) found that the use of high-fluorine water for irrigation did not increase the fluorine content of vegetables. If this be accepted, then the only significantly variable intake is that of drinking-water. At a level of 1.0 p.p.m. the total intake should therefore not exceed 1.82 mg. per day.

Tea is the only article consumed in this country likely to upset this estimate.....

McClure (1949) estimated the fluorine content of forty samples of tea. Two brands popular in this country each contained 18 p.p.m.

dry weight. Only three samples exceeded 100 p.p.m. the highest being 389 p.p.m. On the justifiable assumption that 75-80% of the fluorine may be extracted by boiling water, 2.5 g. of tea-leaves, having a fluorine content of 60 p.p.m., might yield about 0.12 mg. of fluorine. In practice McClure found 0.122 mg. in such an infusion. Thus the British tea ration of 2 oz. per week might provide between 0.36 and 0.38 mg. daily. This would put the total intake up to about 2.20 mg. per day, a figure well within the limit of 4-5 mg. per day at which McClure et al. (1945) considered elimination to be practically complete. There is no reason to doubt the accuracy of measurements of fluorine intake, but estimations of the point of equilibrium between intake and output are less reliable. Excretion of fluorine in the sweat (McClure et al. 1945) has sometimes been disregarded. This is no more than a possible explanation of some discrepancies between biochemical determinations and the results of field surveys of large populations. For example, an intake of 2.2 mg. per day is almost exactly what would be expected if drinking-water contained 1.3 p.p.m. and food 0.3 p.p.m. - levels at which they have been taken without harm by probably over 1,000,000 Americans. The conclusion is therefore unavoidable that in such amounts fluorine is non-toxic.

The poisonous nature of fluorine should be recognised, but it should equally be recognised that it is consumed daily in non-toxic doses by everybody as a natural constituent of nearly all foods and many waters, and there is no evidence whatever that it is in any way harmful in the doses required for the prevention of dental caries.....

Possible Effects of Fluorine upon Industry

The addition of fluorine in the quantities proposed has no effect upon the taste, odour, colour, or acceptability of water for domestic use. It may affect boiler-feed water and zeolites used for water-softening, but this can easily be counteracted if necessary. No serious industrial consequences have been reported from areas having natural high-fluorine waters. Fluorine may inhibit bacterial and enzymatic processes, and its possible effect in industries depending upon them - e.g., brewing and distilling - should not be overlooked.....

Other Methods of Administering Fluorine

It has often been suggested that the benefits of fluorine could and should be obtained by giving it otherwise than in water. Pills and tablets, local application to the teeth, and the incorporation of a fluoride in table salt or chewing-gum have been advocated. But these methods might involve errors in dosage much greater than could occur when it is given in solution, though overdoses large enough to cause danger to health are unlikely. The work of Dean et al. (1934) and McClure et al. (1945) indicated that absorption of fluorine in solid form may be less than when it is taken in water, and there is no reliable guide to the optimum dose as there is when it is in solution. Pills might be given to school-children - but

it would be difficult to make sure that they took them. Moreover it is very important that children under school age should also be included. The use of table salt as a vehicle would be no more successful because salt is not regularly given in infancy. Many years of research on a large scale would be required before the correct dose for such methods could be ascertained.....

..... it has been suggested that milk might be used as a vehicle. But here again the intake would vary greatly and the fortifying of milk in this way would hardly be practicable. Moreover, the deciduous teeth and possibly the permanent teeth may be influenced during breast-feeding, and it may be just as important that the expectant mother should have an adequate intake of fluorine...
...

Local application cannot be summarily dismissed, but the preparatory scaling and polishing, upon which success seems to depend, may be beyond the capacity of an already overburdened dental service. Moreover, it is not yet certain that the reduction in caries would justify the method which could, however, be used in places where it is difficult to treat the water-supply.

With increasing knowledge, some alternative to the public water-supply may be found, but to await the outcome of researches, which must necessarily be long, would deprive the public of benefits which they might receive almost immediately.....

The Dose of Fluorine

Precise control of dosage is necessary if the highest degree of protection is to be given without risk of unpleasant mottling of the enamel. Ample guidance on this point is available from the American experiments. Types of apparatus in common use have been described by Bull et al. (1951) and Harper (1951).

The fluoride ion has been added to water-supplies as sodium fluoride, sodium fluosilicate, and, once or twice for special reasons, as fluosilicic acid and hydrofluoric acid. Feeders for both solutions and solids have been developed from apparatus used in adding chemicals for water purification. There is no doubt that dosage can be maintained well within the limit of the 5% error officially permitted in the U.S.A.....

The Cost of Fluoridation

The American Water Works Association (1949) estimated that the total cost of fluoridation, including capital interest, depreciation, operating costs, and laboratory control, lay between 5 and 15 cents (about 4d. to 1s.) per consumer per year. This cost should be offset many times by savings in the cost of the dental service and by the relief of much suffering and inconvenience. This adequately answers the charge that the use of the public water-supply involves unjustifiable extravagance because only a very small proportion of water is used for drinking whereas

all must be treated. It would seem to be not so much a question of whether we can afford fluoridation but rather of whether we can afford to do without it.

Discussion

There is ample proof that the addition of fluorine to a water-supply deficient in that element will reduce the incidence of dental caries in children. There is also good reason to believe that substantial benefit will persist in adult life. There is, however, some disagreement about how much benefit may be expected. The previous dental health of the community must clearly influence results and be an important consideration in deciding policy.....

The innocuous nature of fluorine in concentrations which will reduce caries has been definitely proved. Experiences in this country may be more convincing than similar but more extensive evidence from the U.S.A. The water at West Hartlepool naturally contains 2.0 p.p.m. of fluorine and that at Maldon contains about 5.0 p.p.m. Adults who have arrived in these towns since the calcification of their permanent teeth have drunk water containing 2 - 5 times the proposed concentration with no ill effect and without knowing that they were doing so. Children reared in these two towns have suffered no consequences other than varying degrees of mottled enamel; but at South Shields, where the concentration is close to that proposed (1.0 p.p.m.), the reduction in caries has not been accompanied by noticeable mottling.

At Maldon it is obviously desirable that the fluorine content of the water should be reduced to prevent the disfigurement of mottled enamel. But could it seriously be argued that all the fluorine be removed and that mottling be replaced by increased dental decay? I submit that such a procedure would be unthinkable and that fluorine should be reduced to no less than 1.0 p.p.m. This simple problem perhaps best illustrates the soundness of controlled fluoridation of public water-supplies.....

.....But to add fluorine to water under controlled conditions is only to supplement the intake of an element, naturally present in many foods and often in water, in order to encourage the development of a more serviceable kind of dental enamel which Nature doubtless intended we should have. It is not unethical nor is it in any way less desirable than improving our flour by adding calcium, or our margarine by adding vitamins - measures instituted with official sanction and widely welcomed by informed opinion.....

It is too early to measure in full the benefits of fluoridation. From eight to fifteen years have been said to be the shortest time that must elapse before full assessment is possible. The earliest experiments have now been studied for six years, and expectations have been fulfilled.....

We add lime to acid water to preserve our pipes from corrosion. If it had been shown that a similar addition would enable us to build stronger bones and better teeth, or otherwise to enjoy better

health, what would be the objection? Fluorine, if added under the conditions that have been outlined, is no more objectionable than lime.

There would, of course, be an outcry from a small and for the most part uninformed minority. In Charlotte, North Carolina, it was announced that fluoridation was to begin on April 1, 1949. Immediately after the appointed day complaints were received attributing to fluorine such things as unpleasant tastes, ruined photographic films, stained clothing, and the death of goldfish. But fluoridation had been deliberately withheld, and when this was announced the complaints ceased. When fluoridation was started on April 25, without announcement, no complaints were received.....

Moreover, tea consumption is insufficient to cause symptoms of fluorosis other than mottled enamel, which can be produced only during calcification of the teeth and therefore at an age when the consumption of tea is least. There is no reason to believe that the people of South Shields drink less tea than those elsewhere in England, yet the fluorine content of their water has improved their dental health to almost exactly the extent expected from experience with similar waters in the U.S.A., and there have been no undesirable consequences.

I have tried to present impartially the evidence for and against the fluoridation of public water-supplies. We are justified in believing that it is possible substantially to reduce the incidence of dental caries without any undesirable effects. The fluorine content of water which confers the greatest benefit without harm is known and can be maintained with great accuracy by established methods of dosing. Other vehicles for fluorine have been tested and have all been found wanting. The cost is relatively unimportant. Thus my six introductory questions have been satisfactorily answered.

E. F. W. MACKENZIE, O.B.E., M.C., M.B., D.P.H.

Director of Water Examination,
Metropolitan Water Board,
London, England.

LANCET - May 10, 1952.

PUBLIC HEALTH ASPECTS OF WATER FLUORIDATION

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When any new technique is advanced, especially one using a potentially toxic substance, the question of safety must be considered. There is ample evidence today to believe that water-borne fluorides when ingested present no other hazard than mottled enamel, which does occur and is detectable when the fluorine concentration exceeds 1.5 p.p.m. It is pertinent to indicate that fluorine is found naturally in most water supplies in varying concentrations up to 15 p.p.m. For many years more than three million persons in the United States have been using water supplies naturally containing fluorine in concentration of 0.9 to 5.1 p.p.m.

More than one million persons use water naturally containing 1.0 to 1.5 p.p.m. F. More than nine hundred thousand use water containing 1.6 to 2.0 p.p.m. F. More than six hundred thousand use water containing 2.1 to 3.0 p.p.m. F. More than one hundred thousand use water containing 3.1 to 5.0 p.p.m. F. More than forty thousand people use water containing 5.1 or more p.p.m. F.

The addition of fluoride compounds to water supplies deficient in the optimum concentration is not to be considered as mass medication or as a therapeutic measure. As just noted, most waters naturally contain some fluorine and the objective of water fluoridation is to control the concentration of the fluoridation at the optimum level. This is true of waters containing excessive fluoridation and those deficient in this element. In so far as considering the addition of fluoride compounds a therapeutic measure is concerned, we must remember that fluorine has no effect on existing caries; its beneficial effect is to prevent, not to cure, dental caries.

There have been no reports of deleterious effects other than dental fluorosis from any area using fluoridated water. On the contrary, such pediatric studies as are being made in Newburgh and Kingston indicate that there are no differences noted in the Newburgh and Kingston children. McClure's studies on height, weight, and bone fracture experience among adolescents and young adults from fluoride and fluoride-free areas show no differences. Studies in fluoride retention where appreciable amounts of fluoride were ingested indicate that the body has a very efficient mechanism for fluoride elimination through the urine, feces, and sweat. It is therefore reasonable to assume that controlled water fluoridation is a safe public health procedure.

It is not surprising that some individuals are still questioning the safety factor. Fifty years from today when water fluoridation probably will be an accepted and routine public health

practice there may still be some who will question it just as there are those today who question water purification through chlorination. There are many who remember the difficulties encountered in getting chlorination accepted generally and the legal battles which had to be fought. The same kind of arguments are being advanced today in the case of water fluoridation.

Summary

Water fluoridation represents a significant advance in public health practice. By a relatively simple procedure of controlling the fluorine concentration of potable water at the optimum concentration, it may be possible to reduce dental caries by 60-65 per cent and, together with current dental practice, to reduce tooth mortality from caries almost to the vanishing point. This new technique can be accomplished at the relatively low per capita cost of 5 to 15 cents per year. The administration of this program presents no serious problem.

From the AMERICAN JOURNAL OF PUBLIC HEALTH
and THE NATION'S HEALTH
November, 1951.

TOXICOLOGICAL EVIDENCE FOR THE SAFETY OF THE FLUORIDATION OF PUBLIC WATER SUPPLIES

In human self-experimentation, as much as 250 mg. of sodium fluoride has been taken at one time without harm. It is evident that there need be no fear of the occurrence of acute poisoning as a result of the accidental or deliberate overfluoridation of a water supply.

The results of animal experimentation show that the prolonged intake of quantities of fluoride too small to induce dental fluorosis does not give rise to any of the nondental manifestations of chronic intoxication by fluorides. Epidemiologic data and clinical and radiographic examinations of exposed industrial workers indicate that only when the fluoride content of a water supply exceeds 5 or 6 p.p.m. will its prolonged usage give rise to detectable osseous changes and then only in the most susceptible persons. The evidence as a whole is consistent in offering assurance that bringing the fluoride concentration in communal water supplies to that known to be optimal for dental health is a prophylactic public health procedure which has an ample margin of safety.

Extract from American Journal of Public Health, December 1952.

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EXTRACT FROM ARTICLE IN "THE MEDICAL OFFICER"
JULY 5, 1952.

We quote from the letter dated 6th June, 1952, from Dr. W. B. Prothro, Public Health Director, City of Grand Rapids, Michigan, replying to Dr. Nisbet's inquiries:-

"You quoted a statement made by Dr. A. L. Miller of Nebraska concerning vital statistics of Grand Rapids. Unfortunately this statement was made before Congress and appeared in the Congressional Record and has been widely publicised, in spite of the fact that these figures are incorrect. I believe the mistake to be an honest error on the part of Dr. Miller, but what actually happened was that he compared the number of deaths from the three diseases mentioned (heart disease, nephritis, intra-cranial lesions) for 1944 for the City of Grand Rapids with the 1948 figures for Kent County, which includes Grand Rapids and which has approximately twice the population of the city alone. In reality there was a decrease in death-rates for both nephritis and intra-cranial lesions in the four years mentioned. As to the heart disease deaths, the actual number of increase is roughly 25 per cent., but the rate is approximately the same. According to intercensal population estimates made by our State Health Department, the population of Grand Rapids increased 22.9 per cent.

"I might also mention that there has been an increase in death-rate for heart disease throughout the United States and as far as we can determine the Grand Rapids rates are comparable to those of the nation. You asked if we had discontinued the use of fluorides in the water. We have not. In fact there has been no serious question raised with our city."

AN ANALYSIS OF THE DELANEY COMMITTEE REPORT
ON THE FLUORIDATION OF DRINKING WATER

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and

W. Philip Phair, D.D.S., M.P.H., Assistant Secretary, Council on
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In mid-July, a special committee of the U.S. House of Representatives, known as the Select Committee to Investigate the Use of Chemicals in Foods and Cosmetics, issued a report (J.A.D.A., August, 1952, p. 243) urging communities to adopt a "conservative attitude" toward the fluoridation of domestic water supplies. The Committee was headed by Rep. James J. Delaney (D., N.Y.). Copies of this report have been distributed widely. Since it appears as an official publication of the 82nd Congress, the report has been interpreted by some individuals as a reversal of the complete endorsements of fluoridation which have been made by health agencies of the federal government. Such is not the case. The report is simply an expression of opinion of its seven members. While vaguely negative in its recommendations, the report itself reiterates the fact that fluoridation has been endorsed and recommended by such federal agencies as the U. S. Public Health Service, and the quasi-official National Research Council. The recommendations of the report, which also included a separate statement by Rep. A. L. Miller (R., Neb.), for the most part ignore the testimony of government scientists and representatives of such organizations as the American Dental Association, American Medical Association, American Public Health Association, Association of State and Territorial Health Officers and many others. In effect, the report was a deferred minority report on the action of Congress itself which earlier had approved an appropriation of funds for the fluoridation of the public water supplies in the District of Columbia. The fluoridation of the public water supplies in the District of Columbia and surrounding communities, with the approval of the full Congress, was in effect prior to the official release of the report of the Committee. The report makes no recommendation for any legislative action by the federal government.

Staff members of the Councils on Dental Therapeutics and Dental Health have carefully analyzed the report of the Delaney Committee as follows:

Serious defects of the recent report on the fluoridation of community water supplies as issued by the House Select Committee to Investigate the Use of Chemicals in Foods and Cosmetics resulted from the failure of the Committee to utilize evaluating procedures that would be acceptable to a scientific group. No responsible scientist or scientific body would be satisfied with the Committee's evaluating technics, as shown by the following examples:

1. The report reads in part that "eighteen witnesses, qualified by their background and training presented their views and recommendations". This statement implies that the Committee carefully selected individuals who were qualified experts through

their participation in fluoride research or through their demonstrated familiarity with the several hundred publications which have reported original studies in the field of fluoridation and its related aspects.

An examination of the list of witnesses who appeared before the Committee suggests that several of the individuals who were invited by the Committee during the early stages of the hearings had not made any studies of significant magnitude dealing with fluorides and did not appear to have adequate background to warrant their testifying as experts in this matter. In fact, some of the witnesses stated that their testimony reported only their personal views. In its conclusions the Committee did not differentiate between the degree of reliability to be attached to the statements of the various witnesses.

2. Some witnesses referred to investigations by other individuals and the allegations of the witnesses were not verified by the Committee through testimony by the original investigators. As a result there was misinterpretation. For instance, the report asserts: "Recent reports of laboratory research indicate that the effect of fluorides on dental decay may possibly be influenced considerably by the absence or presence of magnesium in water." This assertion relates to the investigations reported by A. E. Sobel. Dr. Sobel has reported that statements of this type are not correct. He said that his findings should not be interpreted to question the value of fluoridations. Furthermore, the Committee apparently did not seek further direct evidence on this point. Such evidence is readily available in the literature. A comparison of the analyses of water supplies in Colorado Springs, Colorado, and in Galesburg, Maywood, Aurora, East Moline and Joliet, Illinois, reveals a wide variation in the magnesium content of the waters while the amount of dental decay is low and is always inversely related to the amount of fluoride in the water supply. Thus, whatever the situation may be in test-tube studies, it is apparent that under natural conditions, the presence or absence of magnesium in the water supply does not decrease the dental benefits derived from the fluoride.

3. Another example of the Committee's failure to interpret properly a scientific report is in its statement, "It may not be safe for infants and other children suffering from malnutrition to drink fluoridated water." This statement refers to a study by Maury Massler and Isaac Schour. Drs. Massler and Schour have since called attention to the misinterpretation of the results of their study and pointed out that their article calls attention to the role of malnutrition in increasing the severity of mottling and emphasizes the importance of sound nutrition under all conditions. They explained further that the scientific evidence on hand is sufficient to justify the fluoridation of water to 1 p.p.m. with the assurance that there will be no untoward effect on general health. Again the Committee failed to verify its interpretation through direct testimony from the investigators.

4. In view of the question in the Committee's report concerning the possibility of a difference between fluorides as added

in controlled fluoridation and fluorides as they occur naturally in many public water supplies, the Committee should have requested further information from chemists having special knowledge concerning the ionic equilibria involving fluorides in aqueous solution. Published information was readily accessible to show that the speculation concerning the presence in water of fluorine in nonionic form or organic combination has no logical bearing on the consideration of the fluoridation procedure.

The analytical method which has been employed to measure the fluorine concentration in water is one which measures the concentration of available fluoride ion. It is apparent, then, that the physiological effects of "natural" fluoride-bearing water are related to a fluoride ion, and it is also a fluoride ion which will be present in the water as a result of the addition of the compounds employed for controlled fluoridation.

In addition to the Committee's failure to utilize an adequate scientific approach, its report contains several statements and implications that are open to serious question.

The Committee does not conclude that there are hazards in fluoridation, but expresses a number of vague apprehensions. The committee apparently ignores the mass of evidence derived from the experience of several million people who have used throughout their lifetime a drinking water with an equal or higher concentration of fluoride than that recommended for fluoridation.

In this connection, the report attached little significance to epidemiological studies. The report implies that an epidemiologic study is significant only for a group and not for individuals. It should be pointed out that group data are collected by examining individuals. The data from all individuals are not pooled in order to make the data applicable only for the group, but in order to obtain a higher degree of reliability as these apply to the individuals of the group.

The clinical examination of a few individuals will often fail to disclose effects that may be identified when the examinations are extended to a large group. This is especially important in a study of fluoride effects since the population groups are often naturally subjected to a higher concentration of fluoride than would be justifiable in a clinical test. Furthermore, the exposure may extend throughout the entire lifetime of the individuals in the selected group.

The "addition" or "pilot fluoridation" studies cannot be as crucial a test of safety as is the experience in communities where the fluoride ion concentration is naturally many times as high as that being added in the pilot studies such as those in Grand Rapids, Michigan, Newburgh, New York, and Evanston, Illinois. Bauxite, Arkansas, for instance, had approximately 14 p.p.m. fluoride ion in its water supply. Bartlett, Texas, has about 8 p.p.m. There are at least 40,000 persons who during their entire lifetime have lived in areas in the United States where the drinking water contains at least 5 p.p.m. fluoride ion. These conditions established

by nature, not by men, provide the most convincing evidence of the safety of fluoridation at a level of about 1 p.p.m.

The Committee recognizes the lack of immediate toxicity of fluorides in the concentrations recommended for water supplies but again expresses vague concern over the possible cumulative effect. The report reads:

"The acute toxic effects of fluorides have little bearing upon the hazards which may be associated with its use in public drinking water for the purpose of reducing dental decay. As in the case of most chemicals used or proposed for use in food, the hazard, if any, will result from the cumulative action of small quantities ingested over a relatively long period of time."

Evidence available to the Committee through the report of the Ad Hoc Committee of the National Research Council showed that if cumulative effects of fluorides did develop, they would first become evident in the bones and teeth; yet, no evidence of bone fluorosis could be found in roentgenographic examinations of persons living in areas where the water contains from 1.2 to 3 p.p.m. of fluorine. Even at a level of 8 p.p.m. there was no evidence of bone injury and only minimal change in bone density in 11 per cent of those examined roentgenographically.

The Congressional Committee received a considerable amount of scientific information such as that just cited, and its report contains this paragraph:

"The major portion of the scientific opinion in this country is that the addition to communal water supplies of fluoride compounds, in a quantity sufficient to equal the proportion of about one part of fluorine to one million parts of water, presents no hazard to the public health. Such highly qualified and reputable organizations as the American Medical Association, the National Research Council, the American Public Health Association, the American Dental Association, and the Association of State and Territorial Health Officers have endorsed the program of fluoridating the public drinking-water supply. The United States Public Health Service has issued an unqualified endorsement of the program."

In spite of these scientific opinions as to the safety of fluoridation, the Committee chose to recommend "... that if communities are to make a mistake in reaching a decision on whether to fluoridate their public drinking water, it is preferable to err on the side of caution." This is, in effect, a recommendation for delay of a public health procedure on the basis of vague concerns which are contrary to the vast majority of scientific opinion as noted by the Committee.

Referring to the very mild mottling of dental enamel found in

a few individuals living in areas where the water contains 1 p.p.m. fluorine, the Committee states that "even so-called mild mottling may be unaesthetic." However, the investigators who have had the widest experience in observing mottled enamel agree that the mild fluorosis infrequently observed where water contains 1 p.p.m. fluoride ion does not involve staining and is detectable only by a trained observer.

In spite of extensive testimony on the subject, the Committee report ignores the fact that all responsible groups who favor fluoridation recognize that water intake varies to a significant extent in relation to climate and humidity factors, and that health authorities recommend that the concentration of fluorine in public water supplies be adjusted accordingly. The amount of fluorides necessary to control caries in any region would always be less than that which would cause staining.

The Committee report states that witnesses testified that experiments are now in progress. It implies that adequate studies have not been completed. This latter implication is not correct and it is not in accord with the testimony of many of the witnesses who appeared before the Congressional Committee. All of the reports that have come, both from groups directing controlled fluoridation studies and from groups that have made population surveys in areas where the water supply contains many times the concentration of fluoride that is employed in controlled fluoridation, have indicated that the procedure is without hazard.

Furthermore, the statements that the effect of fluoridation on older age groups and on individuals with chronic disease will be known only after the extension of the Newburgh study and similar projects are incorrect. The most crucial investigations of the physiologic effects of fluorides have been made in areas where the water contains three to eight times as much fluoride as is being added in the Newburgh study. Several hundred thousand individuals, including people of all ages and of varying states of health, are included in these groups.

The Committee apparently disregards the magnitude of the health problem caused by dental caries and therefore assumes that vague apprehensions are sufficient to warrant delay of a public health procedure admittedly capable of greatly reducing tooth decay. The Committee apparently is not impressed by the fact that dental disease, primarily dental caries, was the greatest single cause for the rejection of inductees during the early period of World War II, and the fact that every year the American public spends more for the correction of the results of dental caries than for the treatment of any one other disease.

The Committee notes that it is not concerned with the term "mass medication" and then devotes about 10 per cent of its total report to this subject. A legalistic definition is developed to prove that fluoridation is "mass medication." It seems necessary only to point out that this all-inclusive definition must of necessity prove that the ingestion of food is medication since the food is obviously used to prevent the development of deficiency diseases.

The report asserts that there is no real similarity between chlorination and fluoridation. This conclusion is based on the difference in the immediate action or mechanism of the two procedures, one being used to destroy microorganisms, the other to provide increased resistance to caries. The Committee overlooks a similarity in principle; namely, the addition of a chemical to drinking water in order to greatly reduce the amount of disease. The narrow concept expressed in the report tends to obscure the fact that the addition of suitable chemicals is a universally accepted procedure for improving the quality of drinking water.

In a supplementary report, Representative Miller asserts that only children under eight years of age will be benefited by fluoridation, and concludes that only one person out of eight in the population will receive protection against dental caries. It is obvious that Representative Miller disregards the fact that the individuals drinking the fluoridated water during early childhood will retain the dental benefits throughout life. Eventually, therefore, the entire continuous resident population of a community will receive full benefits from fluoridation.

The Committee further attempts to justify the delay of fluoridation by the assertion that there is a reasonable alternative to this procedure through the topical application of fluorides to the teeth of children. Although the Association recognizes the value of topical application of fluoride, it is necessary to point out that such a program is not an adequate substitute for water fluoridation. The procedure cannot be adapted to the widespread application that would be necessary to prevent dental caries in a significant portion of the population. Representative Miller goes so far as to recommend alternative procedures which have much less scientific basis, such as addition of fluorides to milk or the use of fluoride tablets.

Representative Miller further implies that the Food and Drug Administration might take action against processors of foods prepared with fluoridated water. That this implication is not correct is shown in the statement of policy issued by the acting administrator of the Federal Security Agency, published in the Federal Register of July 23, 1952:

"The Federal Security Agency will regard water supplies containing fluorine, within the limitations recommended by the Public Health Service, as not actionable under the Federal Food, Drugs and Cosmetic Act. Similarly, commercially prepared foods within the jurisdiction of the Act, in which a fluoridated water supply has been used in the processing operation, will not be regarded as actionable under the Federal law because of the fluorine content of the water so used, unless the process involves a significant concentration of fluorine from the water. In the latter instance the facts with respect to the particular case will be controlling."

In the supplemental report, Representative Miller states that: "I am convinced that many of the groups who now endorse fluorides in water are merely parroting each other's opinions. They have done no original research work themselves." This statement is entirely misleading since many of the members of the organizations noted have participated directly in experimental studies, population surveys and other investigations which have demonstrated the safety and desirability of fluoridation. Consequently, the conclusions of these agencies reflect the expert knowledge of their individual members who have participated in the original work relating to this procedure.

The official actions of the American Dental Association and the American Medical Association, with respect to the safety and efficacy of fluoridation, were taken only after critical evaluations of research data. The evaluations were made by councils composed of many of the nation's outstanding medical and dental scientists.

In the supplemental report, Representative Miller refers to the statement of the American Medical Association inserted in the committee's hearings, and quotes from a portion of the statement.

The quoted statement was removed from context in order to suggest that the American Medical Association "did not give an unqualified endorsement for the use of fluorides in drinking water." Actually the American Medical Association has given full approval both with respect to the safety and the desirability of fluoridating water supplies.

The American Medical Association did not "urge" adoption of the dental measure and explained in the hearing that "it was the opinion of the Council that this question (of recommendation for or against) should be answered by the dental profession." The American Medical Association's conclusion in the hearings reads as follows: "Fluoridation of public water supplies in a concentration not exceeding one part per million is non-toxic and its principle is endorsed."

Conclusions

The Delaney Committee report on fluoridation acknowledges that the preponderance of scientific evidence supports the conclusion that fluoridation is a safe and effective procedure for the control of dental caries. The Committee itself concludes that the efficacy of the procedure is amply demonstrated but expresses vague apprehensions concerning possible toxic action from a cumulative effect of the fluoride. The Committee, therefore, in effect recommends that communities should delay adoption of fluoridation pending the accumulation of additional evidence of the safety of the measure.

The Committee apparently was influenced by its lack of regard for the value of mortality and morbidity data in areas with fluoride as compared to areas without fluoride. It is our opinion that the Congressional Committee report suffers from a lack of

adherence to the proper standards of investigative procedure as evidenced especially by its failure to substantiate many statements which it accepted as fact. The Committee also accepted misgivings of a few individuals who appeared as witnesses, in spite of the weight of the evidence furnished by such organizations as the American Dental Association, the American Medical Association, the United States Public Health Service, the National Research Council, the American Public Health Association and the Association of State and Territorial Health Officers. The Committee, through its statement that "dental decay is not contagious nor can it be said to constitute a serious danger to health," implies that a disease is not a community problem unless it is contagious and fails to recognize the fact that dental caries is the most prevalent disease of mankind.

In our opinion, the evidence to demonstrate the safety of the fluoridation procedure is so overwhelming that there is no justification for further denying to large numbers of children the benefits of better dental health which will result from this procedure.

From the JOURNAL OF THE AMERICAN
DENTAL ASSOCIATION
September, 1952.

SUMMARY AND CONCLUSIONS

From the Report of the ad hoc Committee
on Fluoridation of Water Supplies.
Division of Medical Sciences, National
Research Council, Washington, D.C.,
November 29, 1951.

Under normal conditions of living, fluorine is a trace element in human nutrition. A variable and important source of it is drinking water. Many of the public water supplies in the United States are deficient in this element. Children who depend upon such supplies have a high dental-carries-attack rate compared with children living in cities having water supplies containing approximately 1 p.p.m. of fluoride. The advantage of the latter group is considerable and amounts to one-third to one-half as much caries. The caries-preventive effect of adequate fluoride intake is principally conferred upon children until approximately the twelfth year of life - the period during which dentine and enamel of the permanent dentition are being formed. This increased resistance to dental caries is carried over into later life to an appreciable degree.

The results of experimental studies conducted in the laboratory give consistent support to the concept of the inhibitory effect of fluoride on the caries process. There is a safe margin between trace quantities in drinking water which are required for optimal dental health and that amount which produces undesirable physiological effects. The most sensitive indication of the latter amount is interference with normal calcification of the teeth which is manifested in mottled enamel, or endemic fluorosis. This effect, although compatible with caries-resistant tooth structure and, within certain limits, with apparent physiological well being, is esthetically undesirable. The level of fluoride concentration in drinking water that is associated with the appearance of mottled enamel varies with individual susceptibility and with the amount of water consumed. The upper level of safety has been reached, in the northern part of the United States, in domestic water supplies containing approximately 1.0-1.5 p.p.m. fluorine and, in the southern part of the country, with supplies containing approximately 0.7 p.p.m.

There is no reason to believe that prolonged ingestion of drinking water with a mean concentration below the level causing mottled enamel will have an adverse physiological effect. Progress reports in several communities in which sodium fluoride has been added to the water supplies of low fluoride content indicate that this procedure will reduce the caries-attack rate in children. There is evidence to suggest that it will confer an appreciable measure of protection to their teeth after they have become adults.

In view of these considerations, this committee recommends that any community that has a child population of sufficient size and obtains its water supply from sources which are free from or are extremely low in fluorides should consider the practicability and economic feasibility of adjusting the concentration to optimal

levels. This adjustment should be in accordance with climatic factors, and a constant chemical control should be maintained. With proper safeguards, this procedure appears to be harmless. However, it should be conducted under expert dental and engineering supervision by the state board of health. It should not be undertaken unless this supervision can be provided.

The degree of reduction in the prevalence of caries that will actually be realized in a particular community will vary according to local conditions. The procedure will supplement but not supplant other dental health measures. Approximately one-half of the population of this country is living in small villages and rural areas and will not benefit by fluoridation of public water supplies. Other provisions for preventing dental caries in this fraction of the population should be continued and developed.

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